RUNNING GEAR FOR A RAILWAY VEHICLE PROVIDED WITH AN IMPROVED TRANSVERSAL SUSPENSION

The invention relates to a running gear for a railway vehicle comprising at least one wheelset, a running gear frame supported on said wheelset by means of a primary suspension, a secondary suspension for supporting a coach body on the running gear frame, a tilting device for controlled tilting of the coach body about a longitudinal axis of the railway vehicle and a transversal suspension.

Transversal springs and transversal dampers are usually associated with the air springs of air-sprung railway vehicles. In the classical design of air-sprung railway vehicles with two air springs and a central pin, the transversal springs and transversal dampers are usually arranged in a longitudinal eccentric or low central position. Both positions mostly result in unfavourable dynamic behaviour. The arrangement at a longitudinal eccentric position results in parasitic rotational vibrations and a reduction in the efficiency of the suspension elements. The low central position increases rolling motion and thus reduces the damping of the transversal and rolling motion.

Known from US 6,247,413 B1 is a bogie running gear for a railway vehicle with a two-axle travelling gear. The travelling gear is secured by means of a primary suspension to a frame on which a pendulum carrier aligned transverse to the direction of travel is arranged with an interposed secondary suspension. The pendulum carrier is connected pivotally about an axis running in the longitudinal direction of the vehicle to a transverse tiltable traverse bearing the coach body which is constructed in a frame shape and has two traverse crossbars aligned transverse to the direction of travel which are arranged before and behind the pendulum carrier, respectively. The traverse crossbars are supported on the pendulum carrier in the direction of

travel and are arranged displaceably thereon transverse to the direction of travel. The traverse further has a central middle section which connects the two cross-bars below the pendulum carrier, said central middle section is connected to the frame of the running gear to receive longitudinal forces by means of a lemniscate guide such that the traverse can rotate outwards about a substantially vertical axis and can be deflected substantially transverse to the direction of travel.

US 3,877,389 discloses a double-deck passenger car with two-axle running gears, each having a running gear frame supported on the wheelsets by means of a primary suspension and a secondary suspension for supporting the coach body on the running gear frame. The running gears are further each provided with a transversal suspension which are arranged above the secondary suspension and below the bottom of the upper coach body deck in a coach body intermediate space.

It is the object of the invention to provide a running gear of the type specified initially which does not have the afore-mentioned disadvantages of conventional air-sprung railway vehicles. A generic running gear is to be provided which offers the highest possible functionality with very comfortable suspension in a compact design.

This object is solved in a running gear of the type specified initially according to the invention by the features of claim 1.

In the running gear according to the invention the transversal suspension or a transversal damping are arranged above the secondary suspension and underneath the bottom of the coach body. Furthermore, an intermediate support is arranged above the secondary suspension which supports a control member for adjusting the tilt of the coach body with respect to the running

gear frame. The intermediate support has a recess through which a holder supporting the transversal suspension or transversal damping projects.

In this case, the transversal suspension is preferably arranged in the centre of the running gear. As a result of this high and central arrangement of the transversal suspension and/or transversal damping, transversal and rolling motion can be better controlled with less mutual influence. As a result of the central (middle) arrangement of the transversal suspension and/or the transversal damping, no coupling takes place between the transversal and rotational vibrations of the running gear which improves the efficiency of the suspension elements and makes it possible to achieve higher regulating quality in active regulating systems. The running gear according to the invention offers maximum functionality and performance with an extremely compact design. It is distinguished by a relatively simple design and can thus be implemented inexpensively.

Preferred and advantageous embodiments of the running gear according to the invention are specified in the dependent claims.

The invention is explained in detail hereinafter with reference to drawings which show a plurality of exemplary embodiments. In the drawings:

Fig. 1 is a schematic diagram of a first exemplary embodiment of a running gear according to the invention; and

Fig. 2 is a schematic diagram of a second exemplary embodiment of a running gear according to the invention;

The running gear shown in Fig. 1 has a plurality of wheelsets of which only one axle section 1 with one track wheel 2 of a wheelset is sketched for

simplicity. The wheelsets are each provided with brakes (not shown), for example disk brakes and guided in axle guides (not shown).

The running gear further consists of a running gear frame 3 which is supported on the wheelset by means of a primary suspension 4 in the form of coil springs. The coach body 5 of a railway vehicle, for example, the coach body of a long-distance train for passenger traffic, is supported on the running gear frame 3 by means of a secondary suspension 6. Of the coach body 5 substantially only the bottom of the coach body 5 is shown here. The secondary suspension consists of at least two suspension units which are constructed as air springs 6. The air springs 6 each have an air-spring bellows 7, an auxiliary volume 8 and an auxiliary spring 9 which acts in the vertical direction. The components 7 to 9 of the air springs 6 are preferably arranged as close as possible to one another. In this way long connecting lines can be avoided which possibly could result in undesirable throttle effects or a dynamic stiffening at higher frequencies. As is shown in Fig. 1, the components 7 to 9 of the air springs 6 are arranged directly above one another.

Located above the air springs 6 is an intermediate support 10 in the form of a crossbar 10 on which a tilting device known per se is mounted, by which means the coach body 5 can be tilted in a controlled fashion about its longitudinal axis especially when travelling around curves. The tilting device arranged on the intermediate crossbar 10 preferably comprises four rollers 11 which are mounted in special holders on the crossbar 10. Of the four rollers, only two rollers 11 are shown here. Positioned on the rollers 11 is a coach body crossbar 12 which has roller tracks 13 associated with the rollers 11 on its underside. The roller tracks 13 can be constructed as curved or convex. In the exemplary embodiment shown, these substantially consist of flat roller tracks 13 which are inclined in different directions so that their extensions intersect at a point like the sides of a V. The coach body crossbar 12 is

connected to the coach body 5 by means of special connecting elements 14. The rollers 11 and the roller tracks 13 are arranged substantially symmetrically to the longitudinal central axis or vertical longitudinal central plane of the coach body 5.

The ends of a control element 15 are pivoted on the intermediate crossbar 10 and the coach body crossbar 12 where said control element can comprise, for example, an electromechanical, hydraulic or electro-hydraulic tilt actuator, especially a double-acting hydraulic cylinder.

A transversal damper 16 is arranged above the intermediate crossbar 10. The transversal damper 16 is supported with one end on the intermediate crossbar 10 and with the other end on the running gear frame 3 by means of a holder 17. The transversal damper 16 can especially consists of a semi-active transversal damper. The holder 17 associated with the transversal damper 16 is arranged substantially centrally between the two air springs 6 and extends from the running gear frame 3 as far as a level above the air springs 6. For this purpose, the running gear frame 3 can, for example, have a tower-shaped opening or recess 18 through which the holder projects. The running gear frame 3 has two transverse members. The holder 17 supporting the transversal damper 16 is connected to the two transverse members of the running gear frame 3 or is preferably formed by the longitudinal connection of the two transverse members of the frame 3. In addition, a progressive cross spring 19 is attached to this holder 17 which serves to limit the lateral relative path between running gear frame 3 and intermediate crossbar 10 (hold-off device) and is likewise supported on the intermediate crossbar 10. The progressively acting cross spring 19 is arranged directly underneath the intermediate crossbar 10.

In the longitudinal direction before and behind the air springs 6, respectively one cross spring 20 is arranged between the running gear frame 3 and the intermediate crossbar 10, of which only one cross spring is shown here. The cross springs 20 which are supported on the running gear frame 3 and the intermediate crossbar 10 by means of holders are preferably arranged in frame niches.

It can be seen that the transversal damper 16 is arranged between two of the four rollers 11 of the tilting device. The control element 15 of the tilting device is arranged between the two other rollers.

Respectively one vertical damper 21 is arranged between the running gear frame 3 and the intermediate crossbar 10 on the outside of the air springs 6. Depending on the requirements, one or two roll stabilisers 22 are provided. The torsion rod of the roll stabiliser is mounted on the running gear frame 3 whereas the stabiliser guide (guide member) 23 is pivoted on the outside of the air springs 6 on the intermediate support 10.

The exemplary embodiment shown schematically in Fig. 2 differs from the exemplary embodiment according to Fig. 1 especially in that instead of the passively acting cross springs and the passively acting transversal dampers, an active transversal suspension is arranged above the intermediate crossbar 10 and thus above the air springs 6 (secondary suspension). The active transversal suspension is formed here from two active cross springs 24, 25 which are affixed at the upper end of the holder 17, which penetrates through the opening 18 of the intermediate crossbar 10, and on the intermediate crossbar 10. It is also possible to provide merely one active cross spring on the holder 17 instead of two active cross-springs 24, 25. The holder 17 is in turn arranged in the longitudinal central plane of the coach body 5 and has its other end affixed on the running gear frame 3. In this case, the coach body 5

is also provided with a tilt device. It can be seen that a coach body crossbar 12 is attached to the coach body 5 which crossbar has arc-shaped curved roller tracks 13 on its underside by means of which the coach body 5 lies on the rollers 11 mounted on the intermediate crossbar 10.

The invention thus provides a modular running gear which is equipped as desired with the options of active cross springs, semi-active transversal dampers and tilting technology without the need to fundamentally change the interface between running gear and coach body or interfere in the coach body structure.

Reference list

1	Axle section
2	Rail wheel
3	Running gear frame
4	Primary suspension (coil spring)
5	Coach body
6	Air spring (secondary suspension)
7	Air spring bellows
8	Auxiliary volume of air spring
9	Auxiliary spring of air spring
10	Intermediate support (intermediate crossbar)
11	Roller
12	Coach body crossbar
13	Roller track
14	Connecting element
15	Control member
16	Transversal damper
17	Holder
18	Opening (recess)
19	Progressive cross spring
20	Cross spring
21	Vertical damper
22	Roll stabiliser
23	Stabiliser guide
24	Active cross spring
25	Active cross spring